

New Regional Surveys of Soil Geochemistry in Northern Ireland

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Geological Survey of Northern Ireland

Northern Ireland Soils Workshop
Belfast

19th January 2006

Scotland and Northern Ireland Forum for Environmental Research (SNIFFER)

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The Tellus Project

Tasks

- National regional geochemistry survey
- National airborne geophysical survey

Objectives

- Refine existing geological and soils maps
- Image and model concealed geology
- Map rural and urban geochemical conditions

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Project goals

- To provide the basic information for controlled development of Northern Ireland's natural resources
 - minerals, hydrocarbons, geothermal
- To establish a geochemical baseline
 - regional scale, rural and urban
- To contribute to sustainable land-use planning
 - contaminated land; land-fills; geo-hazards
- To help to protect human and animal health
 - trace elements, radon gas
- To contribute to compliance with new legislation



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Funding

- Department of Enterprise Trade and Investment
- The Rural Development Programme, through the Northern Ireland Programme for Building Sustainable Prosperity



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Stakeholder interests - 1

- Natural resources
 - mining and resources companies
 - monitoring and control
- Environment
 - bio-habitats
 - environmental monitoring (land, water, soils)
 - waste disposal and land-fills
 - radon susceptibility prediction



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Stakeholder interests - 2

- Agricultural
 - trace elements anomalies and deficiencies
- Medical
 - spatial correlation of geochemistry with disease
- Planning and roads
 - urban re-development
 - geo-hazard prediction



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EC Directives

- Water Framework Directive
- EC Nitrate Directive
- Directive on Environmental Assessment
- Sewage Sludge in Agriculture Directive
- Habitats and Species Directive
- Directive on Integrated Pollution Prevention and Control
- Framework Directive on Waste
- Soils Directive (pending)



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Geochemistry – rural soils

- 6,000 sites sampled in 2004-05
- Two sampling depths
- Sampling density 1 per 2km²
- 850 remaining samples to be collected in 2006



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Geochemistry – streams

- Survey completed in November 2005
- 3,300 sites sampled in 2005
- Sampled at 1 site per 2.15km²
- Sediments and waters
- Analysis by XRF and ICP



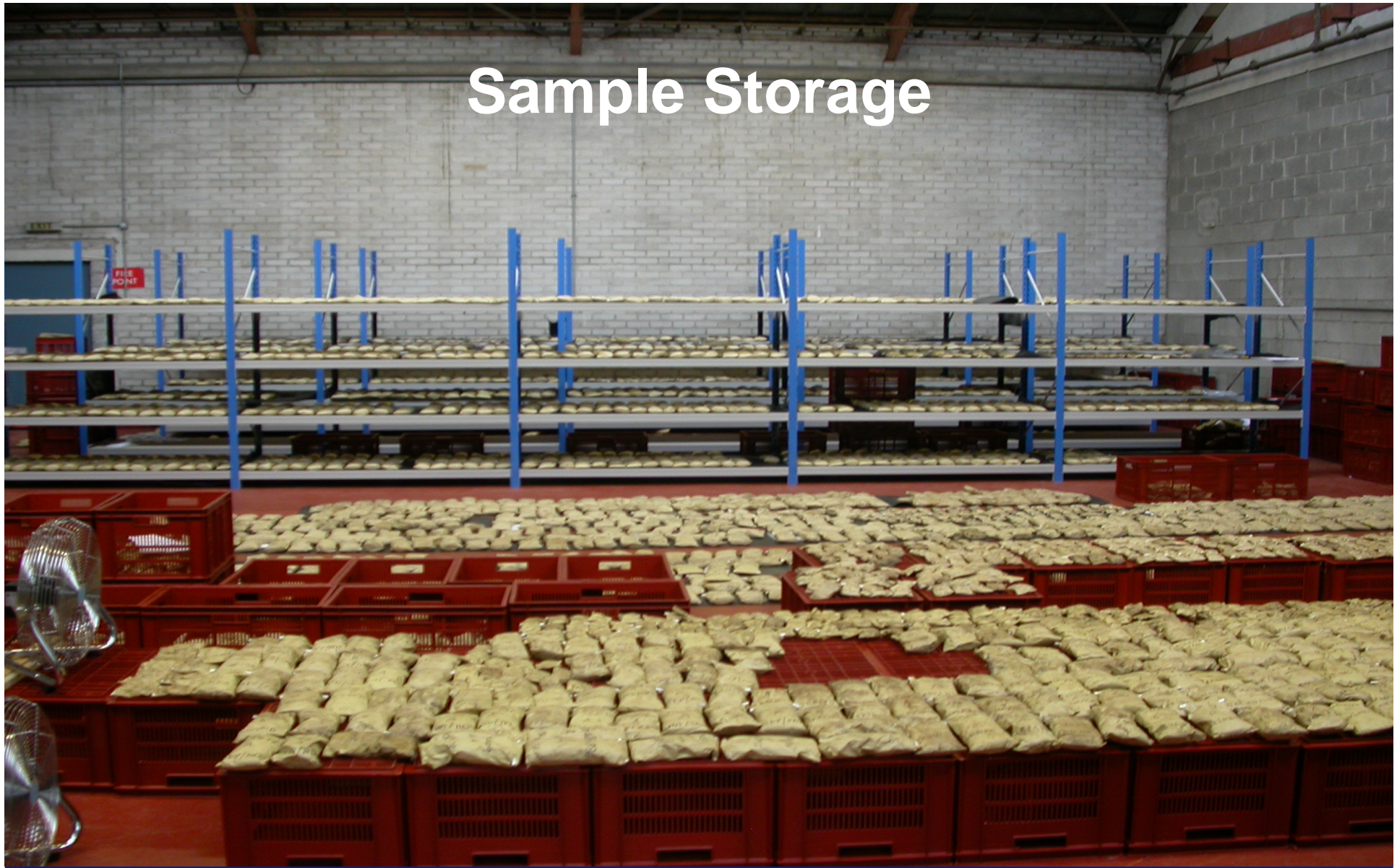
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Sample Storage



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Sampling and analysis



20cm soil sample

- XRF 40 elements, 12 major oxides
- ICP-MS aqua regia (51 elements)
- pH and Loss On Ignition



50cm soil sample

- ICP-MS aqua regia (51 elements)
- ICP-MS "Near-Total" (58 elements)
- Gold, platinum & palladium by fire assay

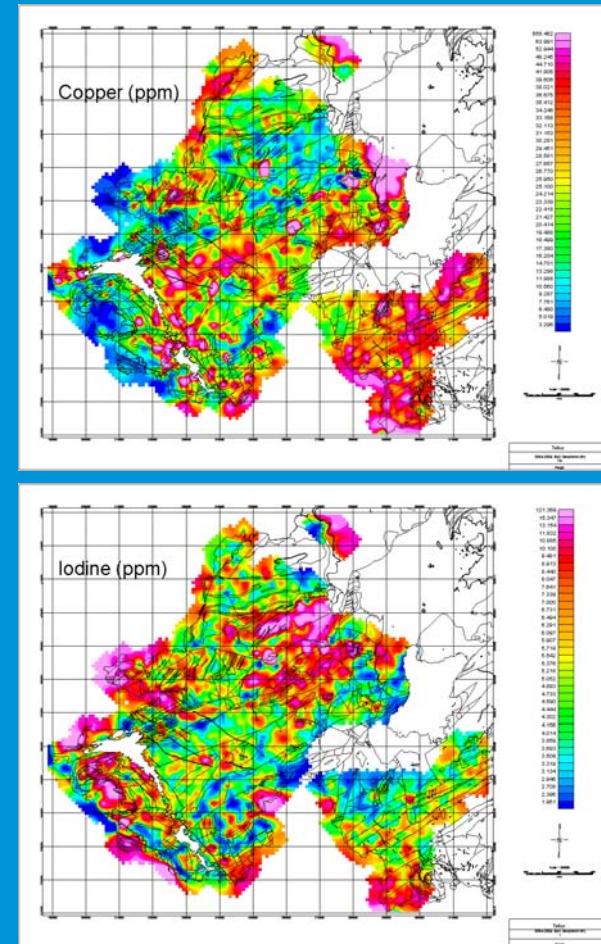
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Geochemistry products

- Digital datasets, multi-element,
 - rural soils
 - stream sediments
 - stream waters
 - urban soils
- Images, 250 x 250m grid



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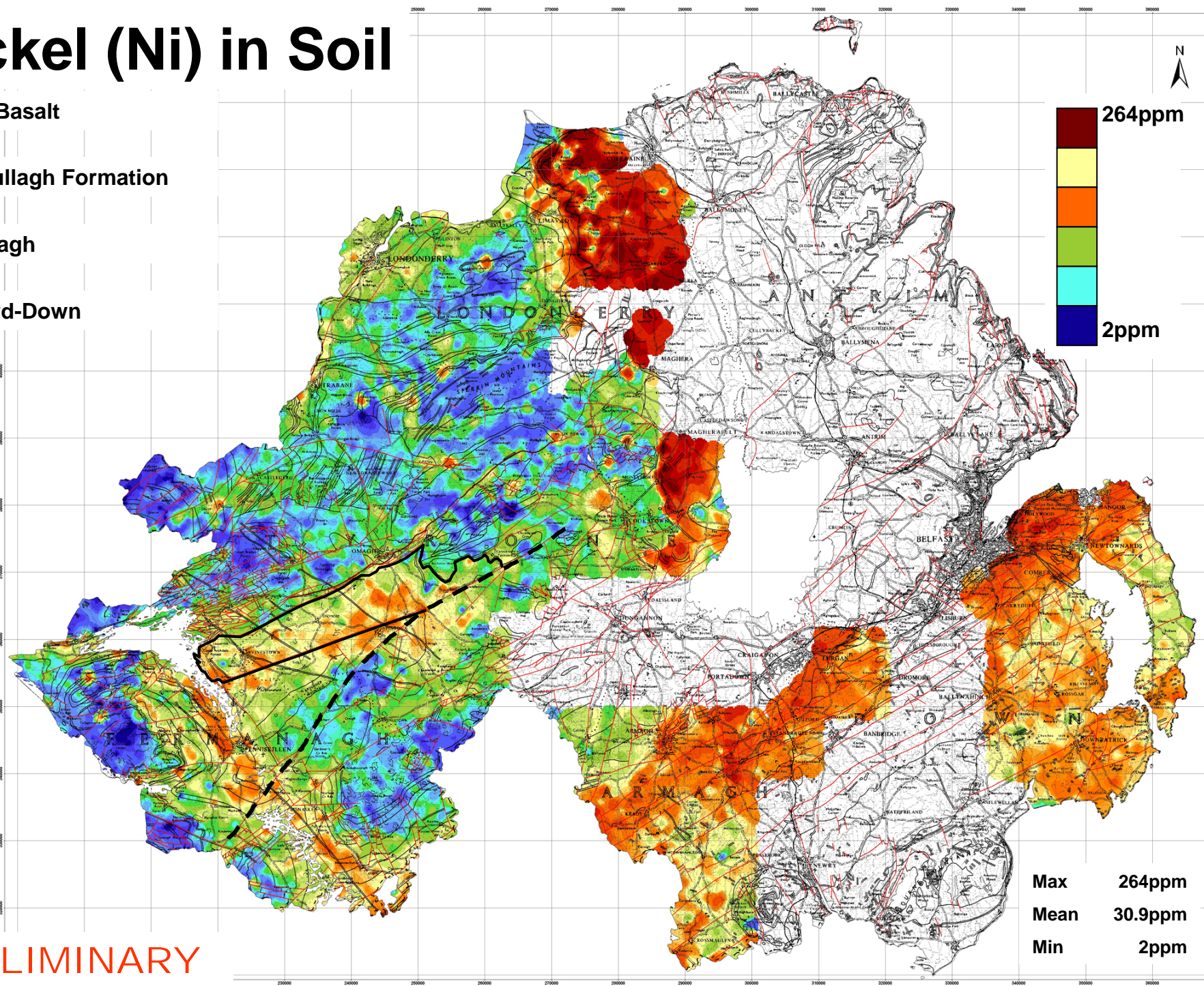
Nickel (Ni) in Soil

Antrim Basalt

Shanmullagh Formation

Fermanagh

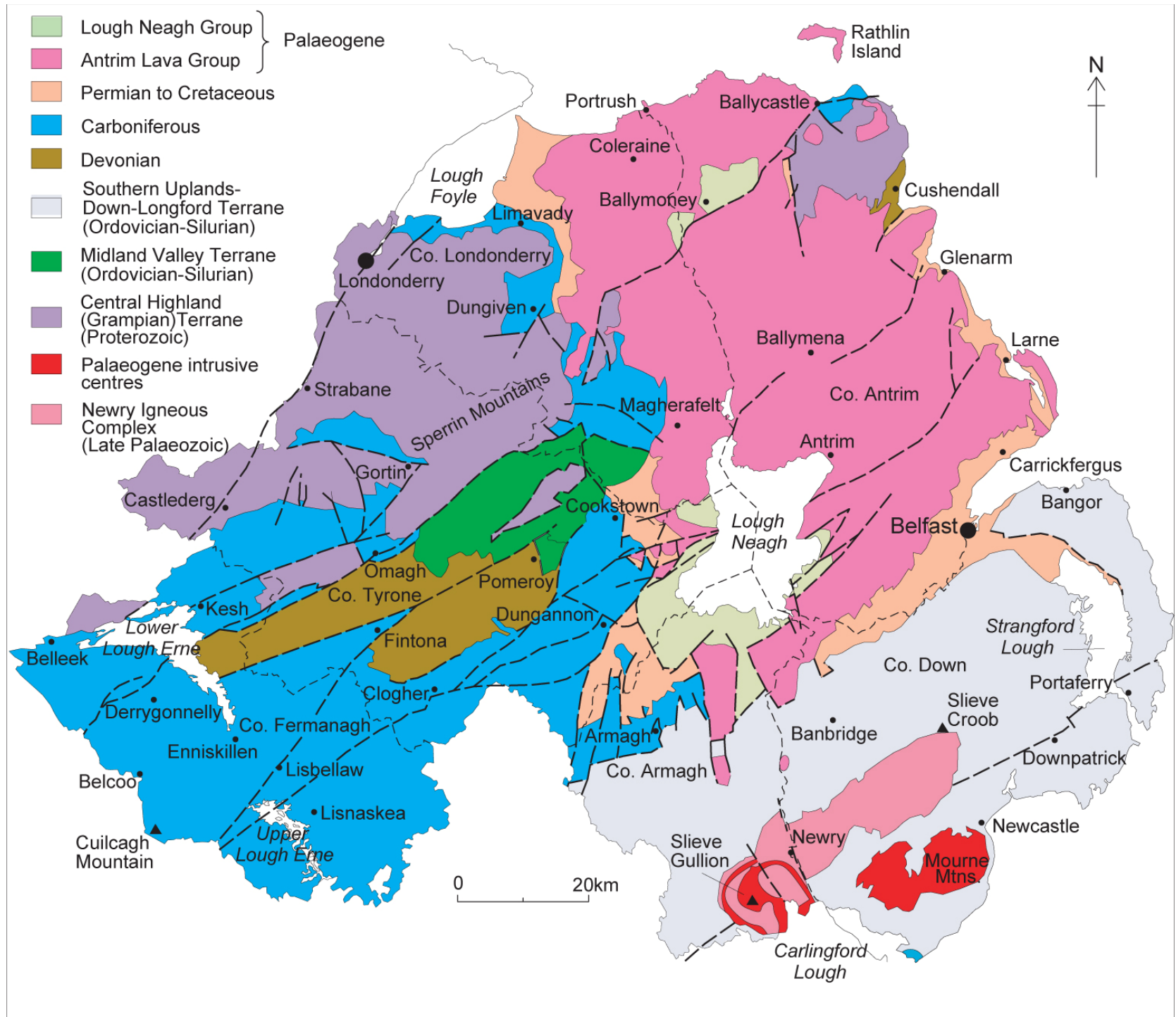
Longford-Down



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Max 264ppm
Mean 30.9ppm
Min 2ppm

Geology



Arsenic (As) in Soil

Anomalies of Known Mineralisation Source

N.E. of Omagh

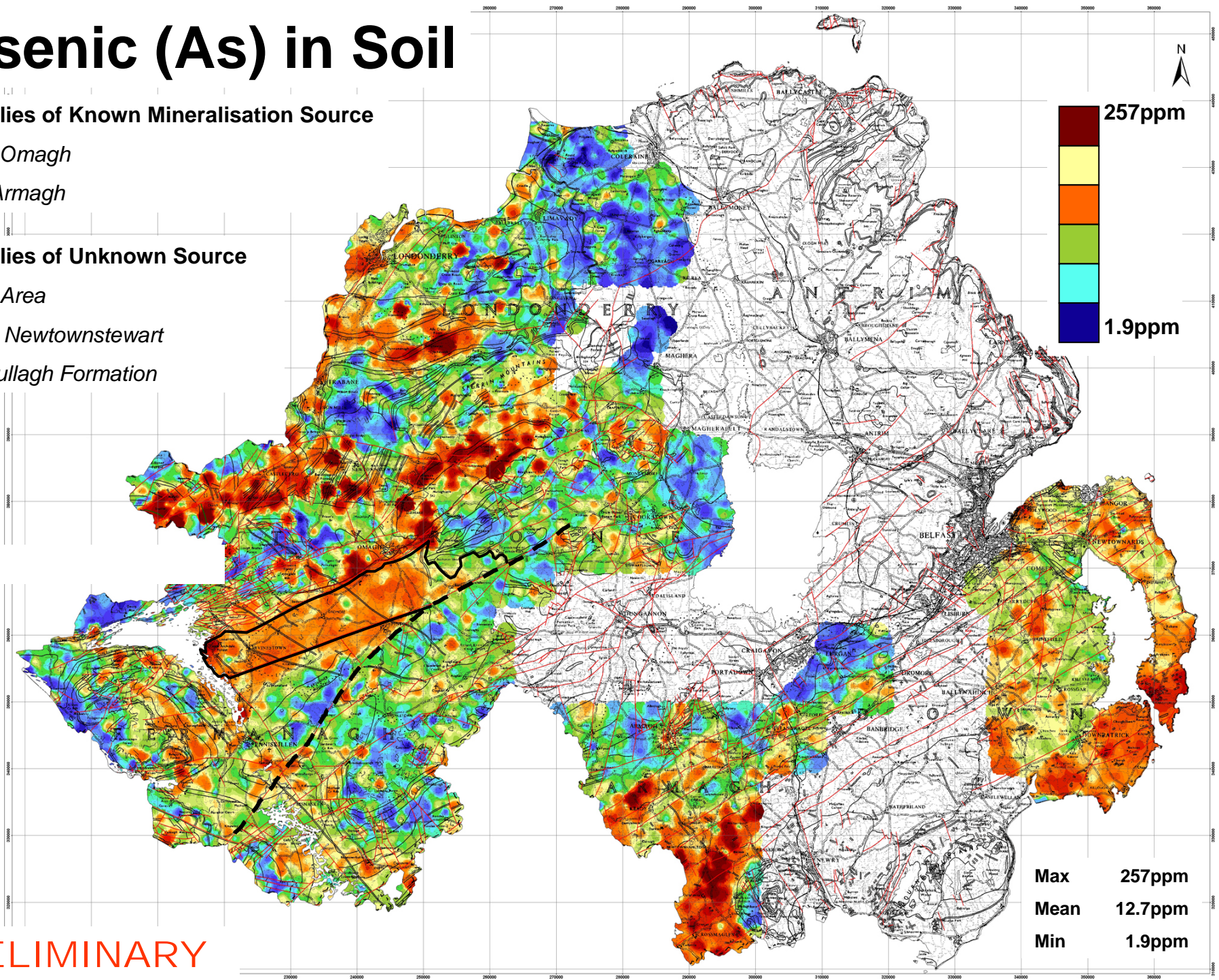
South Armagh

Anomalies of Unknown Source

Claudy Area

Sturrin- Newtownstewart

Shanmullagh Formation

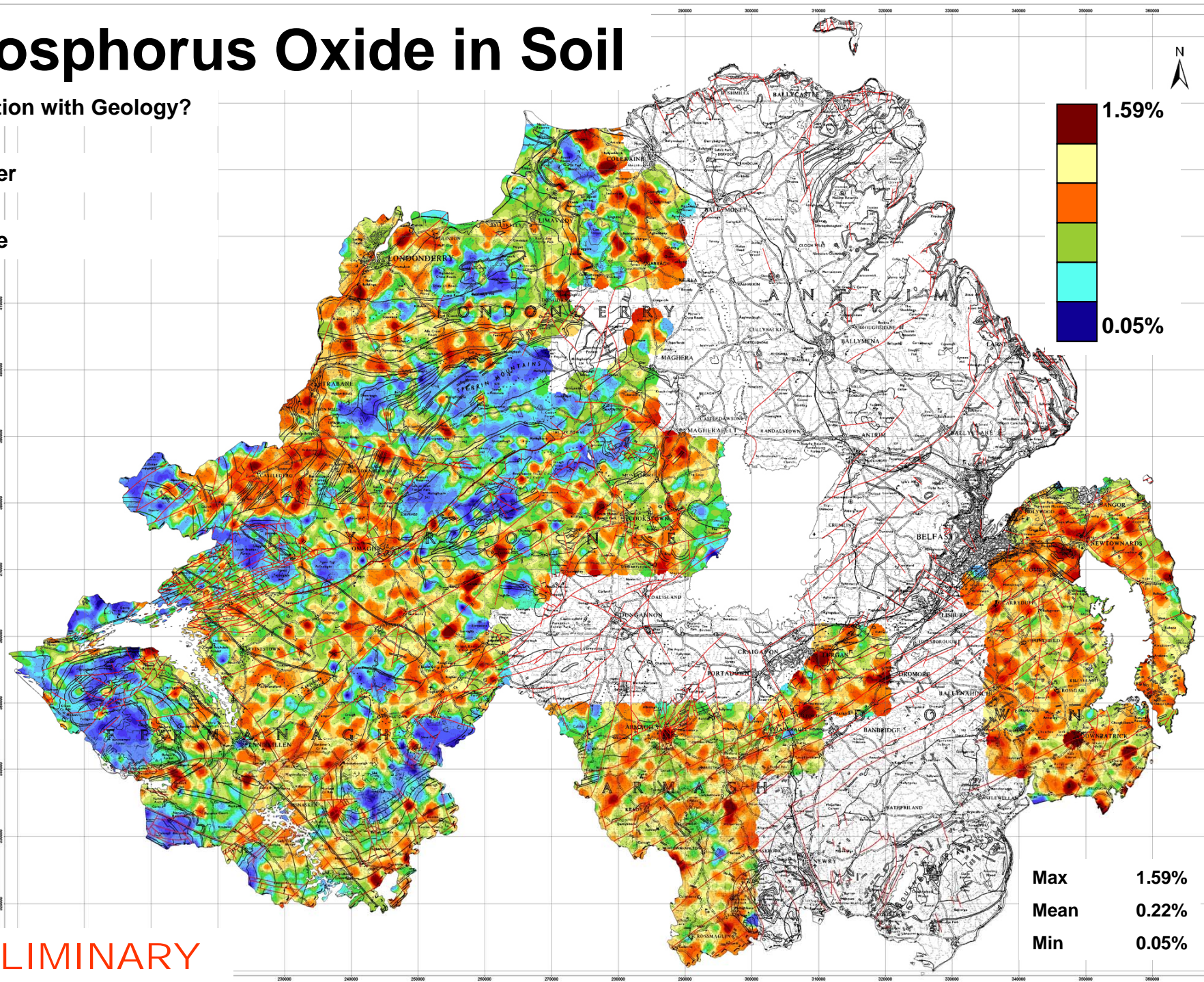


Phosphorus Oxide in Soil

Correlation with Geology?

Fertiliser

Landuse



PRELIMINARY

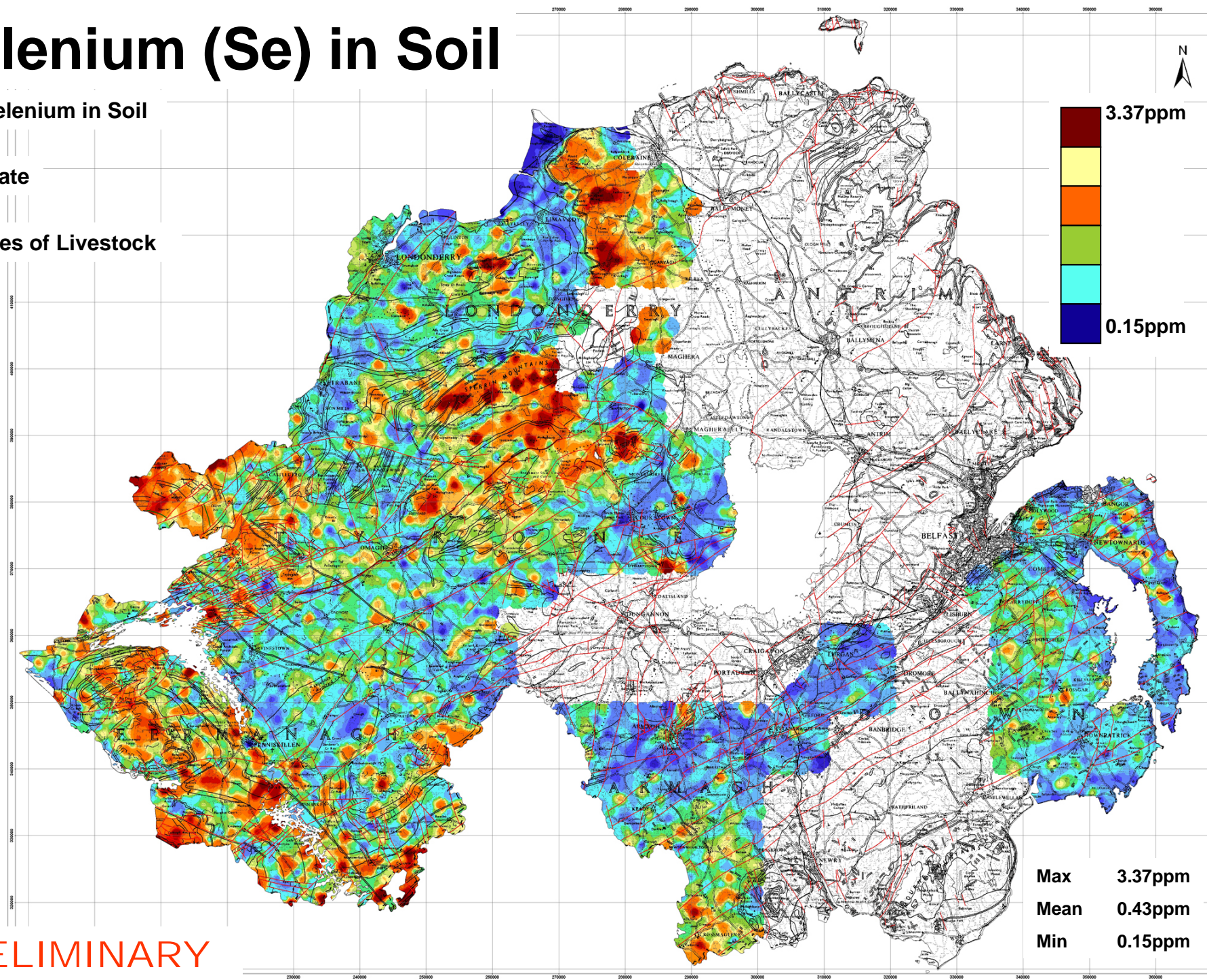
Selenium (Se) in Soil

Low Selenium in Soil

Substrate

Diseases of Livestock

PRELIMINARY



Geochemistry - urban soils 1

- GSUE: Geochemical Survey of the Urban Environment
- Characterises urban geochemistry
- Provides a geochemical framework for more detailed site investigations
- 21 cities surveyed in UK to date



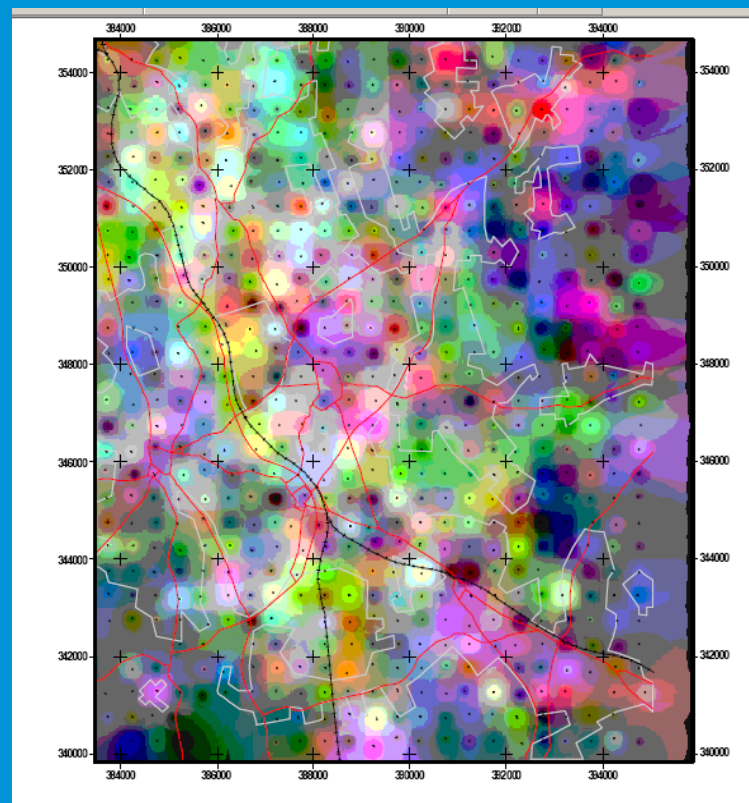
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Geochemistry - urban soils 2

GSUE specifications:

- 4 sites per 2km²
- 15 and 40 cm sampling depths
- Principally inorganic analytes
- Organic sampling possible



Geochemistry - urban soils 3

Proposed survey areas:

- 'Key Settlements' of the Belfast Metropolitan Area Plan 2015
- Londonderry Urban Area
- 230 km², 920 sites



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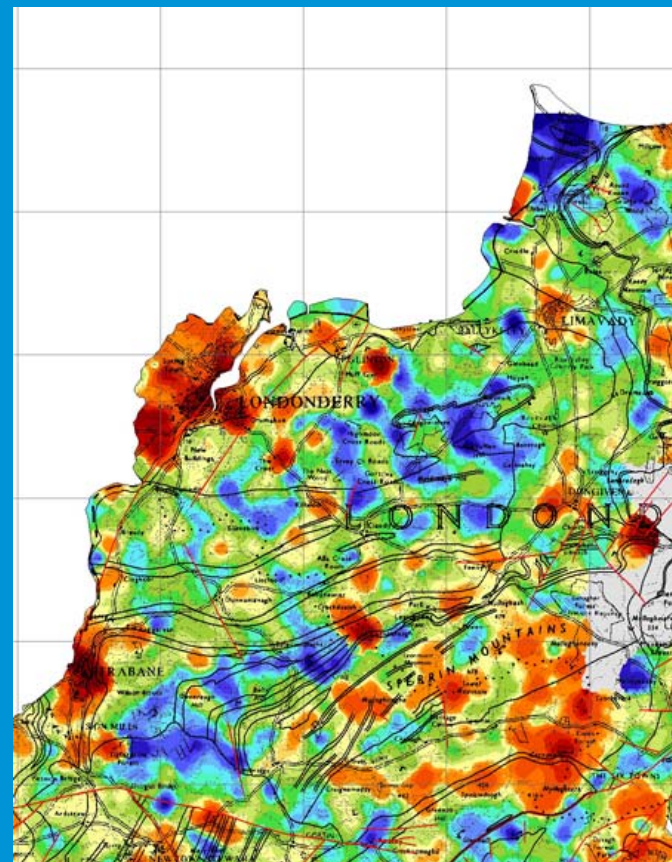
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Geochemistry - urban soils 4

BMAP 2015 - issues:

- Brownfield development
- Effective protection of the environment
- Transportation links
- Lagan Valley aquifer



Tin in soils - Londonderry

Tellus - geophysics

- Data:
 - magnetics
 - ground conductivity
 - radioactivity
- Sampling interval 200m x 65m



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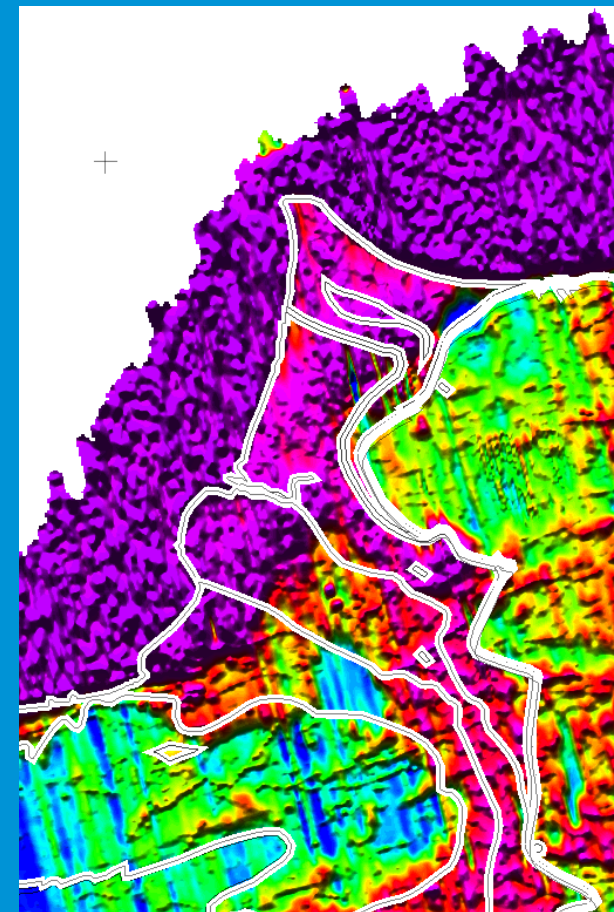
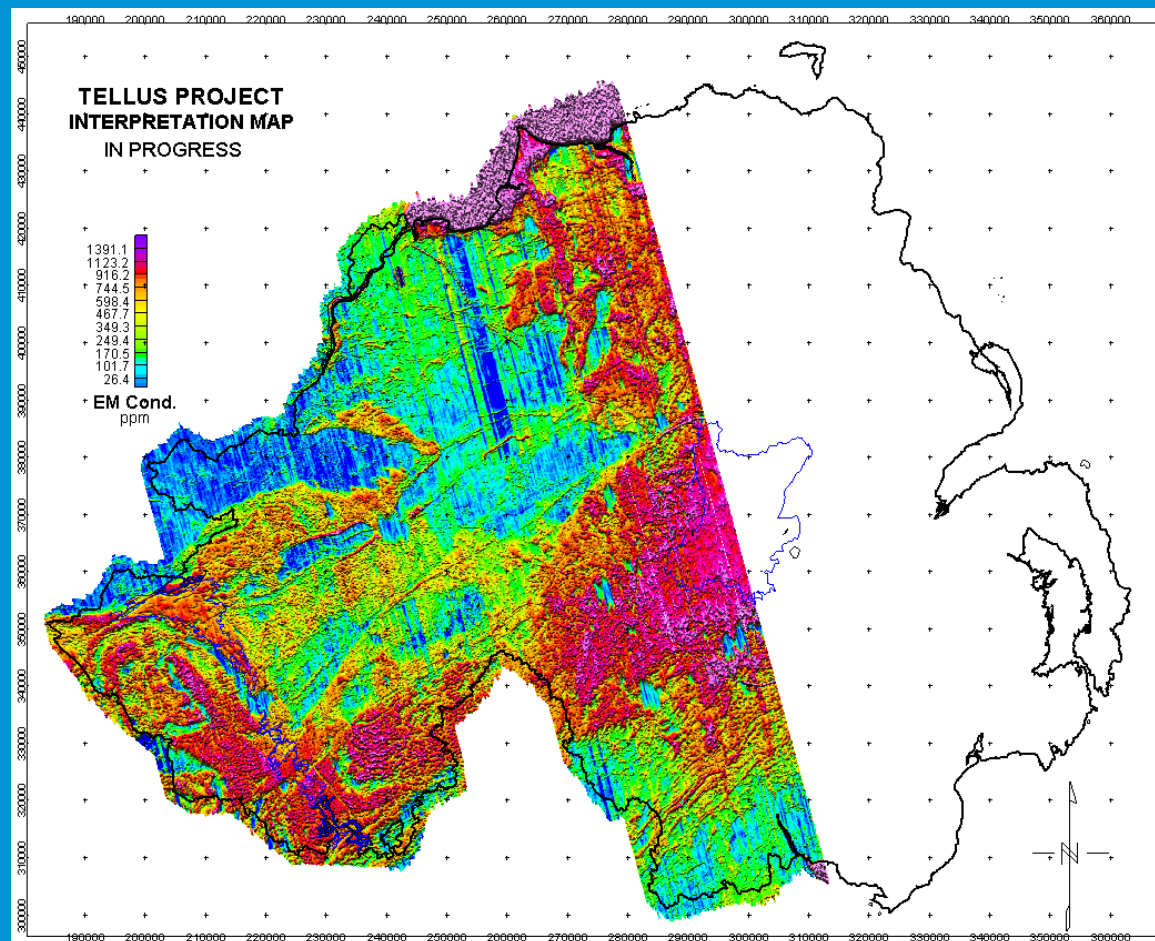
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Ground conductivity and salinisation



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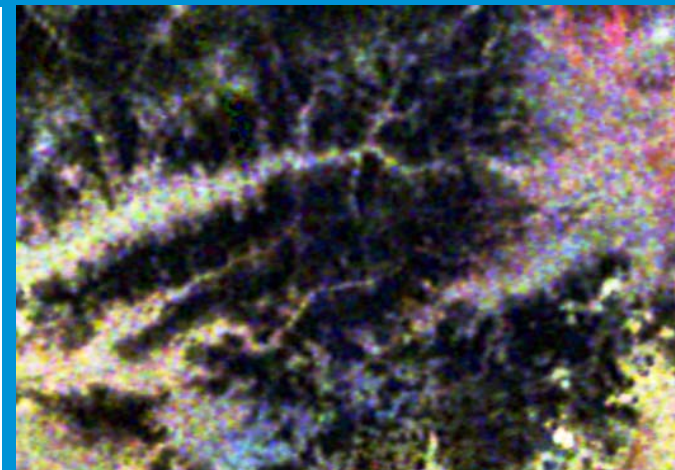
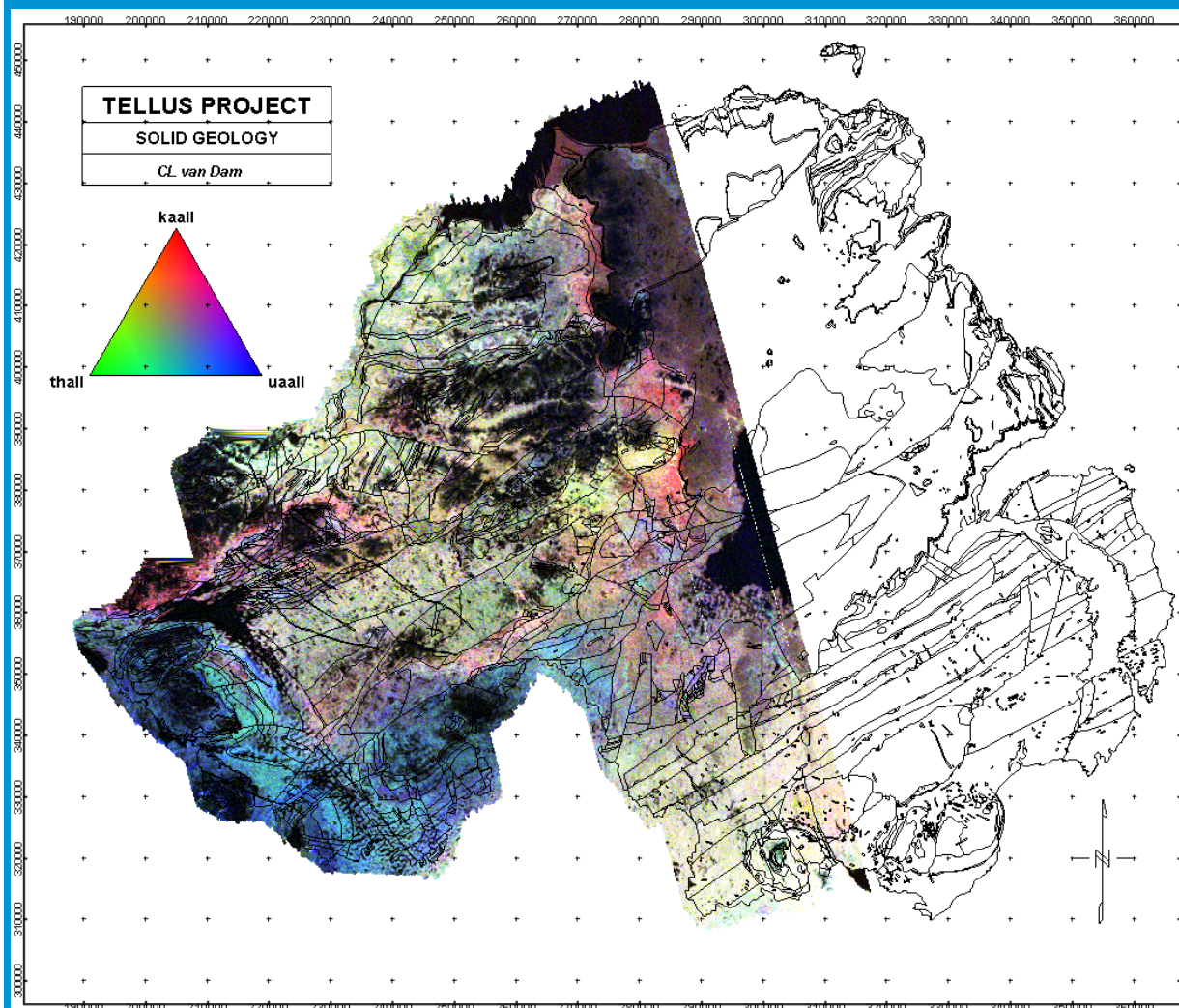
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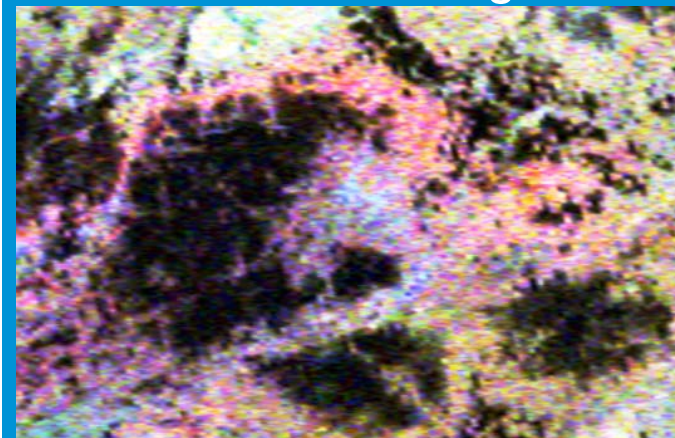
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Gamma-ray spectrometry for U, Th, K and Cs



Stream Drainage



Peat Bogs

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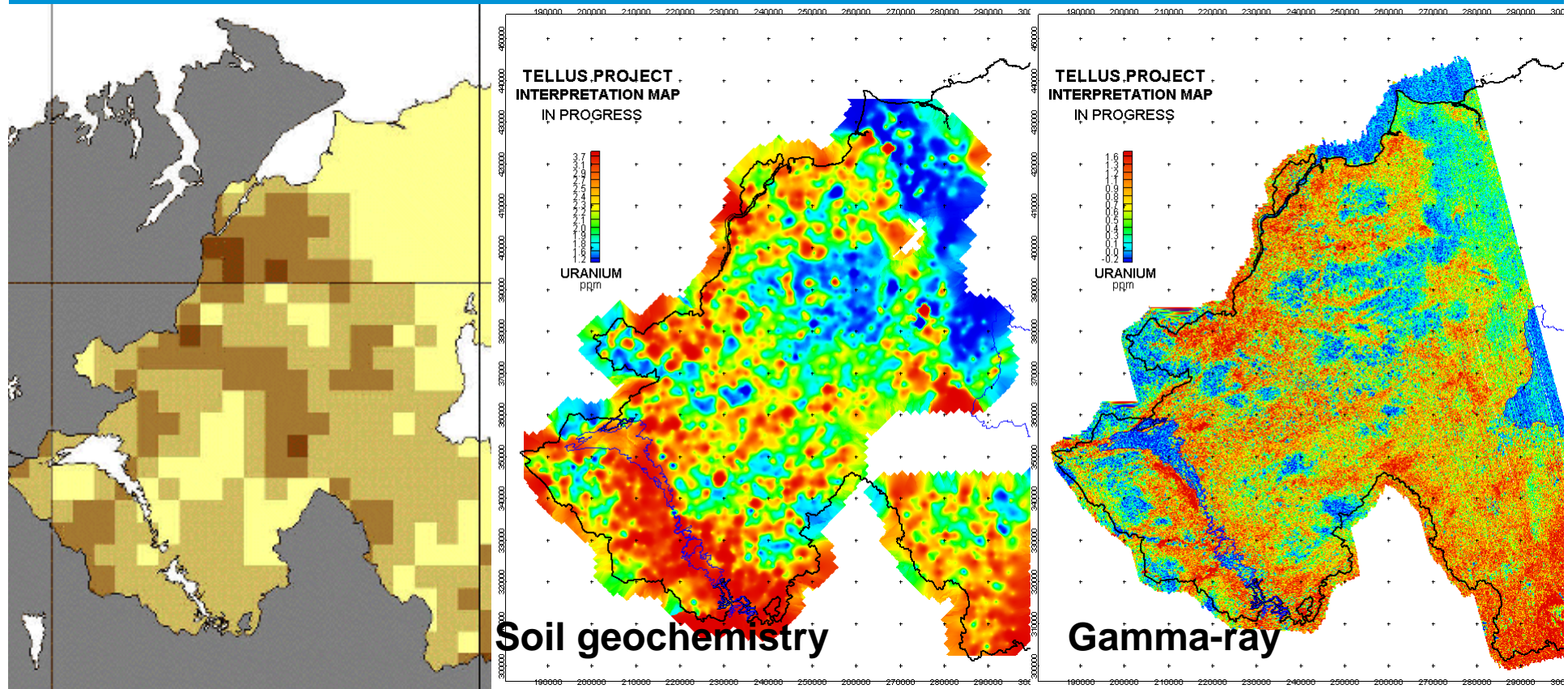
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In-house radon, soil uranium and gamma-ray equivalent uranium (Bi-214)



5 Km Grid

250 m Grid

50 m Grid

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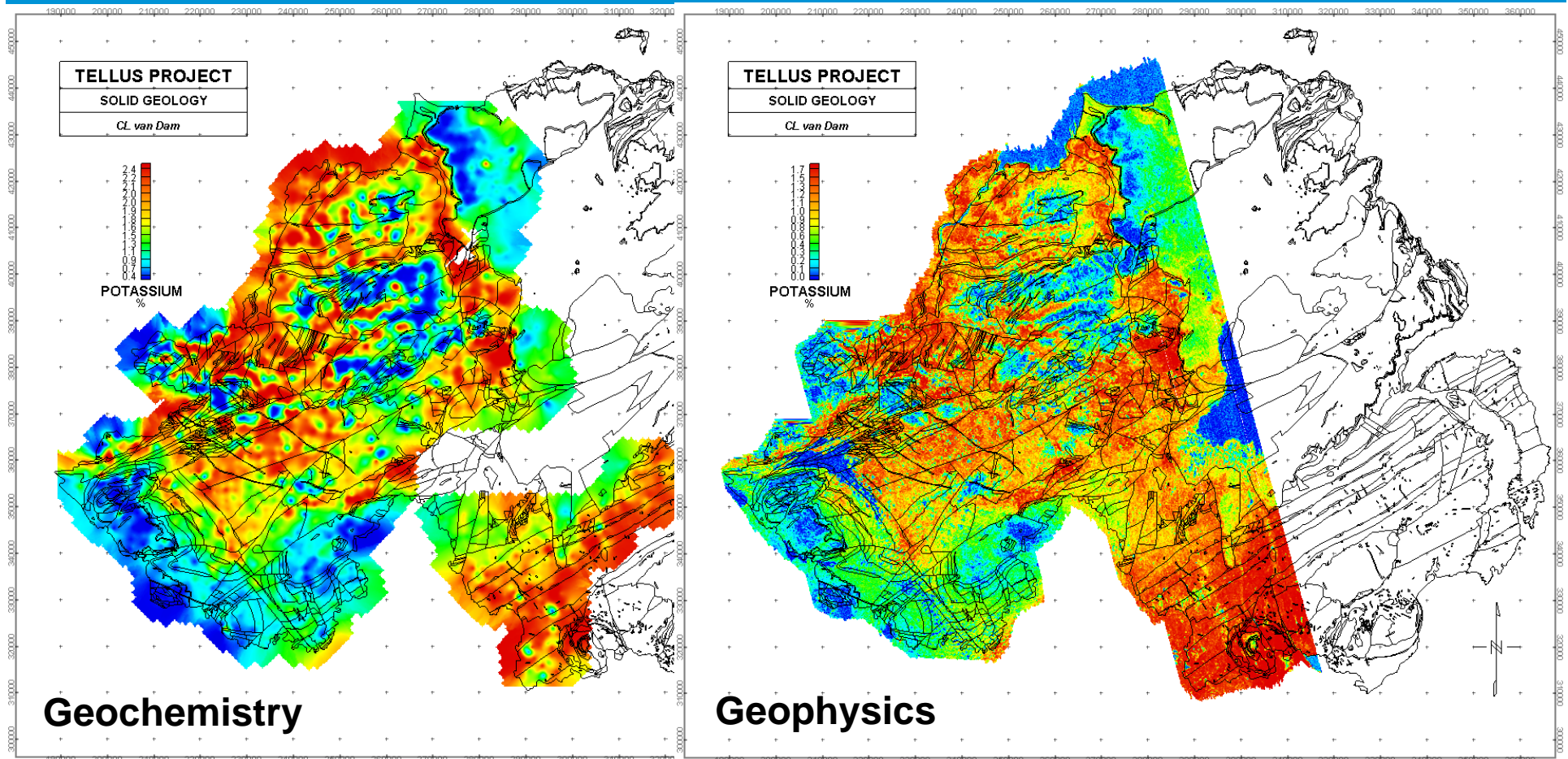
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Soil geochemistry and radiometrics - potassium



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Delivery and licensing

Delivery

- Preliminary data - for consultation
- Fully processed data - available late 2006
- Survey reports - April 2007

Licences

- Academic - for research and teaching
- Standard - for government and commercial users



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Images

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